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ABSTRACT

This first in a series of eight modules for a course titled Quality Assurance Practices describes responsibilities for quality assurance, identified how quality assurance requirements are passed on to other organizations, defines the three phases of activities of the plant, and reviews the eighteen criteria applicable to the quality assurance program. The module follows a typical format that includes the following sections: (1) introduction, (2) module prerequisites, (3) objectives, (4) notes to instructor/student, (5) subject matter, (6) materials needed, (7) procedures, (8) data table, (9) reference materials, (10) test. (The course is one of fifteen technical courses for the second year of a two-year postsecondary curriculum in Nuclear Quality Assurance/Quality Control Technology.) (LRA)

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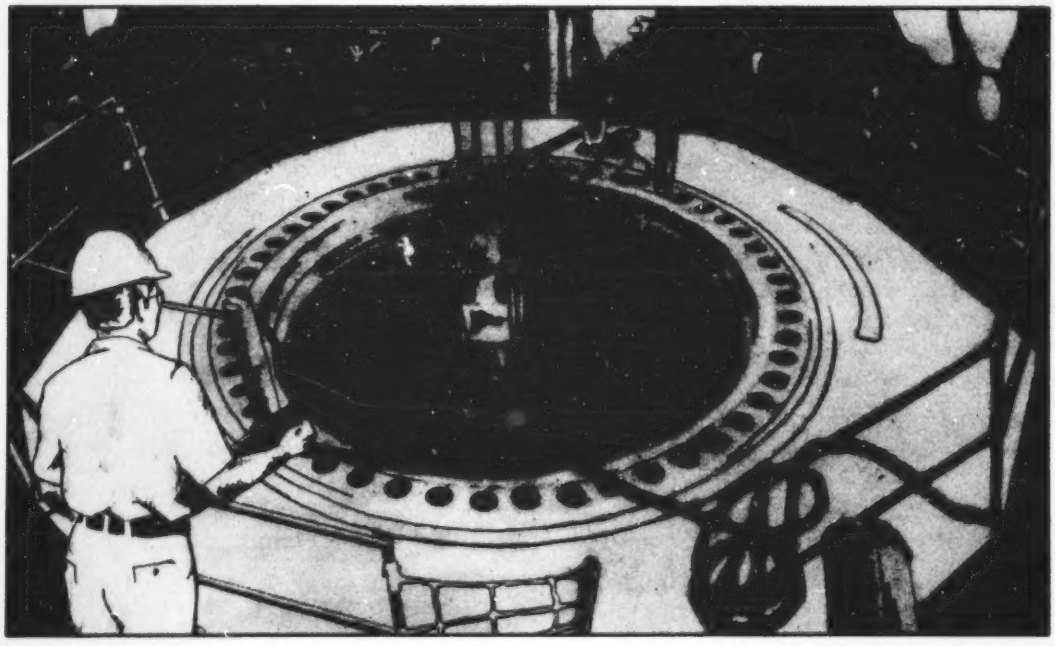
NUCLEAR TECHNOLOGY

COURSE 31 QUALITY ASSURANCE PRACTICES

MODULE 31-1 Overall Quality Assurance Program



CE 024 285

GENERAL PHYSICS CORPORATION
Columbia , Maryland

COURSE MODULES

COURSE 31 QUALITY ASSURANCE PRACTICES

Module 31-1	Overall Quality Assurance Program
Module 31-2	Vendor Qualification
Module 31-3	Receiving Inspection
Module 31-4	Identification, Storage and Handling of Components, Parts and Materials
Module 31-5	Non-Conforming Materials
Module 31-6	Certification and Qualification of Quality Control Inspectors
Module 31-7	Auditing for Quality Assurance
Module 31-8	Document Handling, Storage and Retrieval for Quality Assurance

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This module was prepared for General Physics Corporation by John Espy, General Physics Corporation.

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1979

INTRODUCTION

The Nuclear Quality Assurance/Quality Control Technician may be assigned to a variety of duties within the overall quality assurance program. Many companies view the technician as a "quality engineer in training". Accordingly, a career development pattern is often associated with assignments to the technician.

The Quality Assurance Program applicable to a Nuclear Power Station encompasses design, construction and operation. The program starts with the nuclear utility and extends to all contractors and consultants to the utility. In each specific application, the extent of quality assurance requirements are specified in purchase orders with contractors and consultants. In turn, contractors and consultants specify in their purchase orders with lower-tier vendors the applicable quality assurance requirements.

This module describes the applicant's responsibility for quality assurance and identifies how quality assurance requirements are passed on to other organizations. In addition, this module defines the three phases of activities of the plant: design, construction, and operations. It gives insight on the pyramiding effect of the quality assurance program as it applies to contractors. Finally, this module reviews the eighteen criteria applicable to the quality assurance program and relates these criteria to technical requirements.

MODULE PREREQUISITES

The student shall have completed Course 14 - Introduction to Quality Assurance and Quality Control.

OBJECTIVES

Upon completion of this module, the student/trainee can:

1. Identify the regulatory source for quality assurance requirements applicable to nuclear power plants and name the two principal ANSI standards which provide standards for implementation of regulatory requirements.
2. Relate the application of ANSI quality assurance standards to the design, construction and operations phases of a nuclear power plant.
3. Describe how quality assurance requirements are applied to a contractor at any tier from the owner.
4. Briefly describe the applicable requirements of 10CFR50 Appendix B when given the name of any of the eighteen criteria therein.
5. State the purpose of the ANSI N45.2 series of supplementary standards.
6. Describe how the effectiveness of a quality assurance program may be judged.
7. Describe typical rationale for determining the quality assurance requirements to be placed in a contract for product or services.

NOTES TO INSTRUCTOR / STUDENT

Advance preparation is necessary for the activities described by this module. Activity #1 requires the availability of reference materials listed within the activity. Activity #2 requires use of Quality Assurance Manuals. Such manuals may be obtained from nearby nuclear industries. Either of these activities may be modified as necessary to adapt them to local circumstances.

SUBJECT MATTER

QUALITY ASSURANCE PROGRAM

Source of Requirements

The U.S. Code of Federal Regulations, Title 10, Part 50 (10 CFR 50) requires each applicant of a construction permit or operating license for a nuclear power plant to develop and implement a quality assurance program that meets the eighteen criteria given by Appendix B of 10 CFR 50. The quality program is developed very early in the planning for a nuclear power plant and is implemented as applicable at the start of the design of the plant. The Nuclear Regulatory Commission (NRC) reviews the applicant's quality assurance program in conjunction with reviewing the application for a Construction Permit and the subsequent application for an Operating License. Without an adequate quality assurance program, a nuclear power plant would not be built, much less operated.

Definition and Application

Quality Assurance is defined by Appendix B to 10 CFR 50 as comprising "all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service".

Application of this broad definition to a given activity can be considered as pertaining to two elements of every activity. The first element consists of the "doing" part of the activity and the second element is the "checking" part of the activity. Hence "all those planned and systematic actions necessary..." include actions by the "doer" and the "checker". A more difficult portion of the definition is the determination of what is "necessary". For illustration, consider the driver of an automobile. Driving the car is the doing aspect. Checks can consist of examina-

tions of operator's license, vehicle inspections, posted highway signs, road design (e.g. limited access, radiis of curves, etc.), and police operated radar speed monitors. Notice that one could argue the merits of each check in terms of whether it is necessary for the doing aspect of driving a car. Also notice that "driving a car" implies safe driving. The question becomes "will the check result or tend to result in safe driving?"

Essentially uniform application of the definition of quality assurance is guided by (1) regulations, codes, standards, and specifications, (2) overall responsibility vested in the owner, and (3) technical significance in terms of safe operations. Each of these are further discussed as follows:

- Regulations, Codes, Standards, and Specifications - Principal guidance for the quality assurance program is contained in these documents. Beginning with 10 CFR 50 and Appendix B thereto, NRC issues Regulatory Guides that give more specific criteria than contained in 10 CFR 50, Appendix B. Examples include Regulatory Guide 1.23, Quality Assurance Program Requirements (Design and Construction) and Regulatory Guide 1.33, Quality Assurance Program Requirements (Operation). These Regulatory Guides in turn reference even more specific commercial codes and standards which are acceptable to NRC such as: (1) American National Standards ANSI N45.2, Quality Assurance Program Requirements for Nuclear Power Plants and (2) ASME Boiler and Pressure Vessel Code. From these regulations, codes, and standards, design activities result in the preparation of system and component specifications which detail the plant design in compliance with applicable regulations, codes, and standards.

- Overall Responsibility Vested in the Applicant - The applicant for construction and operation of the nuclear power plant (typically the owner of the plant) has total, overall responsibility for the quality assurance program no matter what work is contracted by the applicant. This requirement of 10 CFR 50 is intended to insure proper application of the quality assurance program by vesting in one organization those decisions to be made in applying quality assurance criteria. The decisions made by the applicant are reviewed by the NRC.
- Technical Significance in Terms of Safe Operation - The quality assurance program must be directed toward an object such as a component or system or service. The degree to which quality assurance activities are applied depends on the object's technical significance in terms of safe operation. In other words, how essential is the component, system, or service to safe operation? All quality assurance decisions within the latitude of regulations, codes, standards, and specifications are made based on the answer to this question.

Development of the QA Program by the Owner

Each applicant for a Construction Permit for a nuclear power plant or nuclear fuel processing facility is required by 10 CFR 50 to include in its Preliminary Safety Analysis Report (PSAR) a description of the QA Program that will be applied to the design, fabrication, construction, and testing of the structures, systems and components of the facility. Every applicant for an Operating License is further required by 10 CFR 50 to include in its Final Safety Analysis Report (FSAR) information pertaining to the managerial and administrative controls to be used to assure safe operation.

These areas of both the PSAR and the FSAR must cover the application of the eighteen criteria of the Quality Assurance Program given by 10 CFR 50, Appendix B. Such application of 10 CFR 50, Appendix B, is directed toward structures, systems, and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the public. In this regard, the requirements apply to all activities affecting the safety-related functions of such systems, structures, and components. These activities include:

- Designing
- Purchasing
- Fabricating
- Handling
- Shipping
- Receiving
- Storing
- Cleaning
- Erecting
- Installing
- Inspecting
- Testing
- Operating
- Maintaining
- Repairing
- Refueling
- Modifying

Phase of Activities

The activities associated with a nuclear power plant logically fall within one of three phases: design, construction and operation. Each of these phases are discussed.

The Design Phase is that phase which produces drawings and specifications for use in procurement of items, construction of facilities and installation of components, and operation of the plant. It sets forth the design of plant systems, structures, and components. A quality assurance program must be established and functional at the outset of the design phase. The QA program confirms the adequacy of the design and insures that required quality assurance criteria are included in specifications and procurement documents.

The Construction Phase is that phase which prepares the site and erects the plant such that the operations phase may commence. It commences with either excavations or receipt of components at the construction site and ends when the components and systems are ready for turnover to operations personnel for startup testing. During the construction phase the Quality Assurance Program applies to all construction activities including receipt, storage, handling, installation, inspection, and test. The QA Program for the design and construction phases must be described in the Preliminary Safety Analysis Report that is a prerequisite for a construction permit.

The Operation Phase is that phase which tests the operability of the plant and subsequently operates the plant. It begins with either preoperational testing or fuel receipt. This phase includes preoperational and start-up testing, normal operations, response to emergencies, surveillance testing, maintenance, chemistry control, radiation protection, radioactive waste control, fire protection, respiratory protection, safety, environmental monitoring, modification control, records and reports management, training, material control and security. All of these operations phase activities are governed by written procedures and are subject to Quality Assurance audits. The Operations Phase Quality Assurance Program must be described in the Final Safety Analysis Report at the time of application for an operating license.

Eighteen Criteria

Eighteen quality assurance criteria are set forth in 10 CFR 50 Appendix B to establish the quality assurance requirements for the design, construction and operation phases of nuclear power stations. The copy of 10 CFR 50 Appendix B, that is reprinted at the end of this module

should be read in conjunction with the following overview of the criteria:

- Organization - This criterion requires clearly defined responsibilities for both the doer and the checker. It also requires that the checker have sufficient authority to identify quality problems and cause them to be fixed. This insures that cost and schedule doesn't overrule quality requirements.

  There are many ways of organizing a quality assurance organization. However, to comply with the requirements of 10 CFR 50, Appendix B, it is necessary that persons or organizations performing QA functions report to a management level whose sole concern is not limited to cost and schedule. As illustrated in Figure 31-1-1, QA typically reports to senior management officials at a level high enough to ensure the separation of responsibility between QA and other departments. This separation is considered necessary to insure objectivity and sufficient freedom from schedules and cost pressures to reduce the risk of compromising safety.

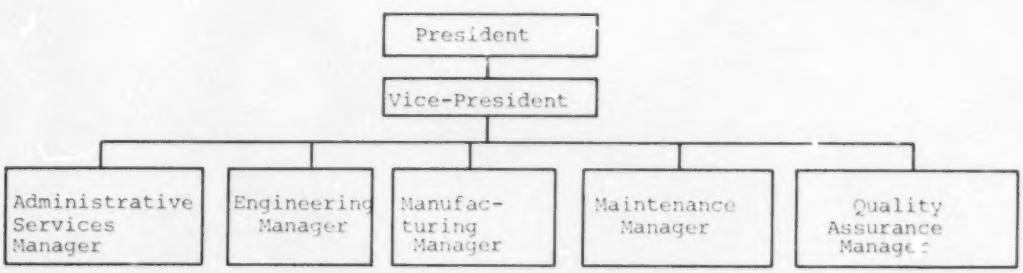

Figure 31-1-1. Example Organization

The QA/QC Technician may be an audit team member responsible for determining that a contractor's

organization meets this criterion.

- Quality Assurance Program - This criterion requires written documents that delineate the scope of the quality assurance program and provide instructions for carrying it out. It also requires training of personnel and insuring that necessary skills are used in each area of the program. It is intended to insure that all portions of the program are pre-planned and properly managed rather than leaving matters to chance.

  Qualification of quality assurance and quality control personnel is based on experience and training. The personnel qualification requirements for non-destructive examination are described in SNT-TC-1A that is published by the American Society for Non-destructive Testing. Qualification of other QA/QC Technicians is governed by ANSI N45.2.6. Both SNT-TC-1A and ANSI N45.2.6 describe three levels of qualification. Level I qualification is the lowest level; it applies to the individual who implements inspection and test procedures. Level II qualification is the next higher level; it applies to the person who evaluates and reports on results of inspections and tests. Level III qualification is the highest level; it applies to the person who approves inspection and test procedures. Module 31.6 of this course describes fully these qualification programs.

  The QA/QC Technician must qualify to Level I and/or Level II for many of the technician's tasks. Also, the QA/QC Technician may participate in audits which determine that other inspection and test personnel are properly qualified.

- Design Control - In theory, a properly designed component that is built exactly to design will perform

in service without problems. This criterion pushes practice toward the theoretical objective. It requires checks, reviews, independent analyses and tests to assure that the designer's specifications and drawings are complete, accurate, and technically satisfactory. The independent reviews, checks, analyses and tests for design control are normally performed by personnel with design engineering expertise. The QA/QC Technician can be an audit team member responsible for confirming that planned control measures have been taken.

- Procurement Document Control - It is axiomatic that the purchaser receives no more than what is ordered. This criterion requires that purchase orders be complete and accurate. It also requires placing responsibility on contractors for including in their purchase orders with subcontractors complete and accurate ordering data. The QA/QC Technician reviews procurement documents to ensure inclusion of appropriate quality assurance requirements whether for materials or services.
- Instructions, Procedures and Drawings - This criterion requires that the activities of doers and checkers be described in instructions, procedures, and/or drawings and that such documents clearly specify acceptance criteria. Activities carried out by the QA/QC Technician are described in procedures and instructions. Also, the QA/QC Technician may be responsible for preparing certain procedures and instructions and for reviewing other procedures and instructions for compliance with governing regulations, codes and standards.
- Document Control - This criterion requires that documents be reviewed prior to their use and that revisions to the documents receive a similar review.

It also requires that the correct document and revision thereof be distributed to and used by the doer and checker. The QA/QC Technician may be responsible for monitoring this system to confirm that documents are being controlled consistent with this criterion.

- Control of Purchased Material, Equipment and Services - This criterion requires that the procuring organization take one or more actions to assure that what is delivered is identical to what is ordered. Assurance actions include qualification of vendors based on audits and knowledge of prior performance, inspection at the vendor's plant and/or at receipt of the ordered items, and documented evidence of compliance supplied by the vendor. The QA/QC Technician may perform a variety of tasks related to this criterion. Inspections may be performed at the supplier's plant or at receipt of the ordered items. The supplier's certifications may be reviewed for conformance with governing procurement documents. Audits may be performed at the supplier's plant. The supplier's quality assurance manual may be reviewed for compliance with the quality assurance requirements specified by the contract.
- Identification and Control of Materials, Parts, and Components - The design of nuclear components often requires use of only certain alloys of specific material condition. To guard against the inadvertent substitution of material types and conditions, this criterion requires the identity of materials to be maintained at all times. Each inspection and monitoring activity performed by QA/QC Technicians involves checks for identity of materials, parts and components. Constant vigilance is needed to insure that properly identified items are handled at all times

in a manner that maintains (i.e. does not lose or destroy) identity of the item.

- Control of Special Processes - Special processes such as welding and heat treating directly affect the material properties of components and parts. Therefore, control of the process is needed to insure that the desired material properties are obtained. Similarly, nondestructive examination is controlled because the examination results are affected by the step-by-step sequence of the examination. This criterion requires control by requiring that special processes be performed in accordance with written qualified procedures by qualified personnel. QA/QC Technicians have a large role in inspecting and monitoring special processes. Courses 26 and 32 of the Nuclear QA/QC Technician curriculum address this role.
- Inspection - This criterion establishes a specific type of checker, i.e. an inspector. The inspector cannot be the doer. Provisions are made for hold points if subsequent work would alter conditions such that the desired inspection could no longer be made. QA/QC Technicians perform a variety of inspections. The Nuclear QA/QC Technician curriculum includes for this reason the courses 27-Metrology, 28-Weld Inspection, 29-Civil Inspection and 30-Mechanical Inspection.
- Test Control - Similar to criterion 9, this criterion requires written procedures for tests because the test results are affected by the step-by-step sequence of conducting a test. This criterion also insures that components and systems are tested for proper operability prior to being placed in service and periodically thereafter. The QA/QC Technician monitors

the conduct of tests to verify that specific controls are met.

- Control of Measuring and Test Equipment - this criterion requires a system that places measuring and test equipment into the user's hands that are sufficiently accurate for the intended use. Use of "activities affecting quality" in this criterion generally means those measurement and test results which confirm acceptability to a preestablished limit. Measuring and test equipment used only for information do not normally need to be calibrated. The QA/QC Technician is frequently the user of measuring and test equipment and therefore, needs to recognize the limitations of the equipment in terms of accuracy. Also, the QA/QC Technician frequently monitors the calibration system to assure compliance with this criterion.
- Handling, Storage and Shipping - This criterion is intended to maintain the quality of an item during the time interval between its manufacture and its installation. The QA/QC Technician performs a variety of inspections and checks to confirm compliance with this criterion.
- Inspection, Test and Operating Status - The key word is "status". By visually observing an item, component or part, one should be able to determine from marking, tagging, stamping or other means that it has been inspected or tested or released for operation. Failure of the item, component or part to physically bear such evidence is assumed to mean that the inspection or test has not yet occurred. However, when items are taken out of service, they are normally tagged to indicate a "do not operate" status. The QA/QC Technician applies the marking, tags or stamp-

ing to represent inspections he or she performs. For those inspections and tests performed by others, the QA/QC Technician monitors for compliance with this criterion.

- Nonconforming Materials, Parts, or Components - Nonconforming items are physically tagged (or otherwise marked) to indicate their rejected status. The identification method is distinctively different than the method used for criterion 14, e.g., a red tag may be used for a nonconforming item while a green tag may be used for an accepted item. If possible, nonconforming items are physically segregated from accepted items. The QA/QC Technician applies the tag (or other marking) to indicate rejected status. Also, the QA/QC Technician monitors the handling, storage and repair of nonconforming items to verify that rejected status marking is maintained until repairs are made and accepted.
- Corrective Action - This criterion requires correction of any problem. Where significant conditions adverse to quality are observed, the cause of such conditions is determined and eliminated. The "doer" normally determines and implements corrective action. The QA/QC Technician identifies the need for corrective action and verifies that effective corrective action has been taken where needed.
- Quality Assurance Records - Millions of pages of records are generated by design, construction and operation of a nuclear power plant. This criterion requires that the Quality Assurance Program define those records to be maintained, their retention period and a method for their recall from storage. Frequently, computer aided records storage and retrieval systems are used. The QA/QC Technician

reviews and monitors records prepared by others to assure completeness, accuracy and legibility and verifies that the records are properly maintained.

- Audits - The audits have two purposes. First, they determine compliance with the documented Quality Assurance Program. Secondly, they measure the effectiveness of the Quality Assurance Program. The latter purpose is more difficult to achieve because it requires professional judgement in many cases. The QA/QC Technician participates as an audit team member in quality assurance audits.

Pyramids of Vendors

The owner of a single nuclear power station is faced with applying the eighteen criteria of 10 CFR 50, Appendix B to several hundred vendors. The legal channel, i.e., the contract channel, is used for this purpose. This overall contracting channel is illustrated in Figure 31-1-2.

As shown in Figure 31-1-2, the first level of contractors below the nuclear utility are those involved with design. There are three major areas of design: the Nuclear Steam Supply System, the remainder of the station's systems and the buildings and structures that house all the systems. There are only five contractors for the Nuclear Steam Supply System: Babcock and Wilcox Company, Combustion Engineering, Inc., General Atomic Corporation, General Electric Company, and Westinghouse Electric Company. The owner contracts with one of these contractors for the reactor and associated reactor systems. There are many architect-engineering firms that offer design services for the remainder of the station's systems and the buildings and structures. Also, many utilities have their own design groups for these areas.

The prime construction contractor may be the nuclear utility or a construction firm contracted by the nuclear utility. The prime construction contractor typically

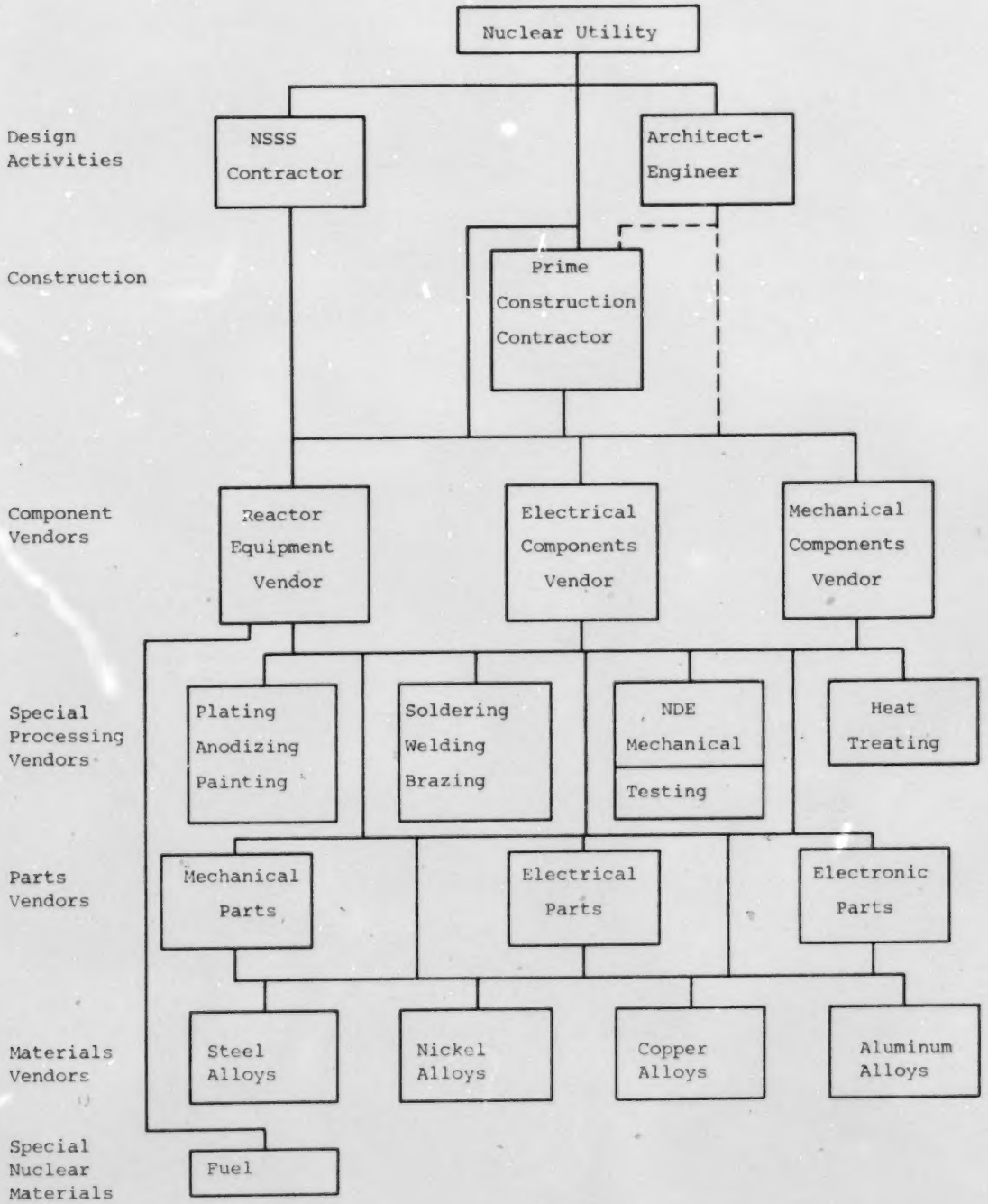

Figure 31-1-2. Pyramid of Vendors

subcontracts to obtain the diverse skills needed to construct a nuclear power station.

The next tier of vendors is the component suppliers. Contracts may be placed with this tier by the nuclear utility, the architect-engineer, and the NSSS supplier. This tier of vendors delivers pressure vessels, pumps, valves, motors, turbines, generators, switchgear, piping, etc. Delivery is normally to the construction site where components are stored until the construction contractor is ready to install them.

The next tier of vendors is the parts suppliers. Procurement with parts suppliers may be for standardized parts that are commercially available or for specialized parts requiring processing not available within the purchaser's resources. Parts suppliers may receive purchase orders from any of the higher-tier contractors.

The next tier of vendors includes the specialty shops. These are vendors that offer specialized processing that may not be economically feasible for the construction, component or parts vendors. This category includes welding, brazing, heat treating, non-destructive and destructive examination, plating, anodizing, painting and highly specialized machining such as electro-discharge machining. The nuclear utility, NSSS supplier, prime construction contractor, component supplier and parts vendor could have orders with this category of vendors.

The final tier of vendors includes the material suppliers. Depending on the material condition being purchased, this tier includes melters and metal finishers. Any of the other tiers of vendors may have direct orders with the material suppliers.

Contracts, Subcontracts, Orders, Purchase Orders

Various terms are applied to the legal document that

binds an agreement between the purchaser and the supplier. This legal document may be termed contract, subcontract, order, or purchase order. Nonetheless, these terms are synonymous from a legal viewpoint and are used interchangeably in this module.

A contract binds both the buyer and the supplier. In its most simple form, this means that the buyer must pay the supplier the agreed upon price upon delivery of the purchased item or service and the supplier must deliver the purchased item or service as required by the contract. In reality, many more conditions of agreement are described by the contract pertaining to both the buyer's and the supplier's obligations. Quality Assurance requirements are applied as a portion of these agreements.

The nuclear utility, being at the head of the pyramid of vendors, places contracts for those items to which the nuclear QA program applies that contain three types of quality assurance requirements. First, QA requirements are specified which apply to the work performed by the contractor. Secondly, QA requirements are specified which instruct the contractor to place in subcontracts with other vendors QA requirements appropriate to the item or service ordered. Thirdly, QA requirements are specified which require the contractor to require their contractors to place appropriate QA requirements in any further contracting of work. These latter two types of requirements insure that appropriate QA requirements are passed on within contracts no matter how far down the pyramid of vendors contracts are placed. Criterion VII of Appendix B to 10 CFR 50 requires such passing down of appropriate QA requirements.

Application of Quality Assurance Criteria

As previously described, quality assurance criteria are applied to the applicant for license of a nuclear power plant by the U.S. Code of Federal Regulations and the appli-

cant must apply appropriate quality assurance requirements to all tiers of contractors. Determination of what is appropriate is a complex process. The decision is not normally made by a single individual unless very specific guidelines have been previously agreed upon by all concerned parties.

American National Standards, ANSI N45.2, Quality Assurance Program Requirements for Nuclear Power Plants for Design and Construction and ANSI N18.7, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants give similar guidance for applying quality assurance requirements to contractors. This guidance states that procurement documents shall include provisions for identification of quality assurance requirements applicable to the items or services procured. This may be accomplished in various ways, such as (1) invoking ANSI N45.2, (2) invoking applicable sections of ANSI N45.2 or ANSI N18.7, or (3) invoking specific requirements that meet the intent of portions of ANSI N45.2 or ANSI N18.7.

The key is the phase "applicable to the items or services procured". The technical significance of the item or service is judged in terms of its role in the safe and reliable operation of the nuclear power plant. Items and services that are essential to safe operation receive more stringent quality assurance requirements than those that are nonessential to safe operation.

The ASME Boiler and Pressure Vessel Code (Code) governs manufacture and installation of components which pressure boundaries. This Code includes in Section III, Subsection NA, Article NA-4000 criteria for quality assurance programs for contractors who fabricate or install Code components. Code quality assurance criteria are essentially the same as those of ANSI N45.2 but they apply only to the work which is governed by the Code. Therefore, the Code quality assurance requirements are typically

sufficient for a fabricator of a Code component. But for the installer, additional criteria are imposed by the system design specification which typically requires application of quality assurance requirements of both the Code and ANSI N45.2.

Utilities often use a "Q" list to assist in the designation of quality assurance requirements. The Q list identifies those components and systems which require application of quality assurance requirements in order to meet the licensing commitments to the NRC.

The extent of application of quality assurance requirements by contract may be affected by the extent of quality assurance activities of the purchaser. That is, the purchaser may elect to perform quality verification activities and not require the contractor to perform all quality verification. In this regard, the purchaser may consider such activities as (1) performing inspections and tests at the contractor's plant, (2) performing inspections and tests of components upon receipt, and (3) inspecting and testing the work of the construction contractor.

Standardization of QA Requirements

The criteria of Appendix B to 10 CFR 50 and the requirements of ANSI N45.2, ANSI N18.7, and the ASME Boiler and Pressure Vessel Code give latitude in the methods of meeting the criteria and requirements. While such latitude is desirable to permit application of quality assurance requirements commensurate with the significance of the item or service, it can be undesirable from a competitor's view point. If one company is forced to use elaborate methods while a competitor to that company is permitted to use skimpy methods, an undesirable imbalance results. Some degree of standardization of methods is therefore desirable provided that sufficient latitude is retained to

permit acceptance of two or more equally effective methods of meeting the same requirement.

An additional degree of standardization of methods of implementing QA criteria is provided by a series of standards that are required to be used to supplement ANSI N45.2 for the design and construction phases and ANSI N18.7 for the operations phase. These standards are:

- ANSI N45.2.1 - Cleaning of Fluid Systems and Associated Components During the Construction Phase of Nuclear Power Plants
- ANSI N45.2.2 - Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants (During the Construction Phase)
- ANSI N45.2.3 - Housekeeping During the Construction Phase of Nuclear Power Plants
- ANSI N45.2.4 - Installation, Inspection and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations
- ANSI N45.2.5 - Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants
- ANSI N45.2.6 - Qualifications of Inspection, Examination and Testing Personnel for the Construction Phase of Nuclear Power Plants
- ANSI N45.2.8 - Supplementary Quality Assurance Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems for the Construction Phase of Nuclear Power Plants
- ANSI N45.2.9 - Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants
- ANSI N45.2.10 - Quality Assurance Terms and Definitions

- ANSI N45.2.11 - Quality Assurance Requirements for the Design of Nuclear Power Plants
- ANSI N45.2.12 - Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants
- ANSI N45.2.13 - Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants
- ANSI N45.2.14 - Design and Quality Assurance Requirements During the Design and Manufacture of Class IE Instrumentation and Electric Equipment for Nuclear Power Generating Stations
- ANSI N45.2.15 - Requirements for the Control of Hoisting, Rigging, and Transporting of Items at Nuclear Power Plant Sites
- ANSI N45.2.16 - Supplementary Requirements for the Calibration and Control of Measuring and Test Equipment Used in the Construction and Maintenance of Nuclear Facilities
- ANSI N45.2.18 - Supplementary Quality Assurance Requirements for Installation, Inspection and Testing of Precast, Prestressed, Preplaced and Heavy Aggregate Concrete During the Construction of Nuclear Power Plants
- ANSI N45.2.19 - Supplementary Quality Assurance Requirements Related to Soil and Foundations During the Construction Phase of Nuclear Power Plants
- ANSI N45.2.20 - Supplementary Quality Assurance Requirements for Sub-Surface Investigations Prior to the Construction Phase of Nuclear Power Plants
- ANSI N45.2.21 - Quality Assurance Program Requirements for Nuclear Power Plant Fuels
- ANSI N45.2.22 - Supplementary Requirements for Inspection of Dimensional Characteristics
- ANSI N45.2.23 - Qualification of Quality Assurance

Relationship of QA and Technical Requirements

The term technical requirements refers to the contents of codes, standards, specifications and drawings which prescribe the features and characteristics to be inherent in the item or service. Technical requirements may also govern the type and nature of processing activities incumbent in producing, inspecting, and testing the item or service. Each contract specifies the technical requirements and the quality assurance requirements to be met.

Review of the eighteen criteria of Appendix B to 10 CFR 50 quickly points out that technical requirements are stated, referenced or implied in every criterion. It is the technical requirements, which include product acceptance criteria, that establish the inherent quality to be expected. If technical requirements change, the product or processing of the product must also change to be consistent with the revised technical requirements. Adding or deleting ANSI N45.2 or any of the supplementary QA standards does not change the inherent quality required by the technical requirements. The purpose of the QA specifications is to require managerial and administrative controls which more positively assure that required inherent quality is in fact achieved. Therefore, the effectiveness of any QA program is best measured in terms of its ability to ensure (1) establishment of technical requirements consistent with design criteria and (2) compliance with established technical requirements by all concerned organizations.

For illustration of the relationship between technical and QA requirements, Criterion VI of 10 CFR 50 Appendix B, requires measures for controlling the issuance of documents. One of the measures is review of documents for adequacy. The question is "what is adequate?" ANSI N45.2 states that

reviewers of documents "shall have access to pertinent background information upon which to base (their) approval and shall have an adequate understanding of the requirements and intent of the original document". Therefore, adequacy is considered in terms of technical criteria. If the document is design document, adequacy involves the technical bases by which the contents of the document were derived and are supported. If it is a manufacturing document, adequacy involves the completeness and accuracy of its contents in translating the design criteria into manufacturing instructions. Adequacy of any document can similarly be traced, directly or indirectly, to some governing technical requirement.

In continuing this illustration, document control measures must also include provisions for distributing documents to the user. Again the concern is with assuring that document control is proceding in a technically satisfactorily manner. The concern is with users of the document. If the document is also distributed to non-users, the criterion no longer applies.

APPENDIX B—QUALITY ASSURANCE CRITERIA FOR NUCLEAR POWER PLANTS AND FUEL REPROCESSING PLANTS

35 FR 10498

Introduction. Every applicant for a construction permit is required by the provisions of § 50.34 to include in its preliminary safety analysis report a description of the quality assurance program to be applied to the design, fabrication, construction, and testing of the structures, systems, and components of the facility. Every applicant for an operating license is required to include, in its final safety analysis report, information pertaining to the managerial and administrative controls to be used to assure safe operation. Nuclear powerplants and fuel reprocessing plants* include structures, systems, and components that prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. This appendix establishes quality assurance requirements for the design, construction, and operation of those structures, systems, and components. The pertinent requirements of this appendix apply to all activities affecting the safety-related functions of those structures, systems, and components; these activities include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying.

As used in this appendix, "quality assurance" comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material, structure, component, or system which provide a means to control the quality of the material, structure, component, or system to predetermined requirements.

I. Organization

40 FR 3210C

The applicant [1] shall be responsible for the establishment and execution of the quality assurance program. The applicant may delegate to others, such as contractors, agents, or consultants, the work of establishing and executing the quality assurance program, or any part thereof, but shall retain responsibility therefor. The authority and duties of persons and organizations performing activities affecting the safety-related functions of structures, systems, and components shall be clearly established and delineated in writing. These activities include both the performing functions of attaining quality objectives and the quality assurance functions. The quality assurance functions are those of (a) assuring that an appropriate quality assurance program is established and effectively executed and (b) verifying, such as by checking, auditing, and inspection, that activities affecting the safety-related functions have been correctly performed. The persons and organizations performing quality assurance functions shall have sufficient authority and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions; and to verify implementation of solutions. Such persons and organizations performing quality assurance functions shall report to a management level such that this required authority and organizational freedom, including sufficient independence from cost and schedule when opposed to safety considerations, are provided. Because of the many variables involved, such as the number of personnel, the type of activity being performed, and the location or locations where activities are performed, the organizational structure for executing the quality assurance program may take various forms provided that the persons and organizations assigned the quality assurance functions have this required authority and organizational freedom. Irrespective of the organizational structure, the individual(s) assigned the responsibility for assuring effective execution of any portion of the quality assurance program at any location where activities subject to this Appendix are being performed shall have direct access to such levels of management as may be necessary to perform this function.

40 FR 3210C

II. Quality Assurance Program

35 FR 10498

The applicant shall establish at the earliest practicable time, consistent with the schedule for accomplishing the activities, a quality assurance program which complies with the requirements of this appendix. This program shall be documented by written policies, procedures, or instructions and shall be carried out throughout plant life in accordance with those policies, procedures, or instructions. The applicant shall identify the structures, systems, and components to be covered by the quality assurance program and the major organizations participating in the program, together with the designated functions of these organizations. The quality assurance program shall provide control over activities affecting the quality of the identified structures, systems, and components, to an extent consistent with their importance to safety. Activities affecting quality shall be accomplished under suitably controlled conditions. Controlled conditions include the use of appropriate equipment; suitable environmental conditions for accomplishing the activity, such as adequate cleanness; and assurance that all prerequisites for the given activity have been satisfied. The program shall take into account the need for special controls, processes, test equipment, tools, and skills to attain the required quality, and the need for verification of quality by inspection and test. The program shall provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. The applicant shall regularly review the status and adequacy of the quality assurance program. Management of other organizations participating in the quality assurance program shall regularly review the status and adequacy of that part of the quality assurance program which they are executing.

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[1] While the term "applicant" is used in these criteria, the requirements are, of course, applicable after such a person has received a license to construct and operate a nuclear power plant or a fuel reprocessing plant. These criteria will also be used for guidance in evaluating the adequacy of quality assurance programs in use by holders of construction permits and operating licenses.

* Amended 36 FR 18301.

III. DESIGN CONTROL

Measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled. Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components.

Measures shall be established for the identification and control of design interfaces and for coordination among participating design organizations. These measures shall include the establishment of procedures among participating design organizations for the review, approval, release, distribution, and revision of documents involving design interfaces.

The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. The verifying or checking process shall be performed by individuals or groups other than those who performed the original design, but who may be from the same organization. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, it shall include suitable qualification testing of a prototype unit under the most adverse design conditions. Design control measures shall be applied to items such as the following: reactor physics, stress, thermal, hydraulic, and accident analyses; compatibility of materials; accessibility for inservice inspection, maintenance, and repair; and delineation of acceptance criteria for inspections and tests.

Design changes, including field changes, shall be subject to design control measures commensurate with those applied to the original design and be approved by the organization that performed the original design unless the applicant designates another responsible organization.

IV. PROCUREMENT DOCUMENT CONTROL

Measures shall be established to assure that applicable regulatory requirements, design bases, and other requirements which are necessary to assure adequate quality are suitably included or referenced in the documents for procurement of material, equipment, and services, whether purchased by the applicant or by its contractors or subcontractors. To the extent necessary, procurement documents shall require contractors or subcontractors to provide a quality assurance program consistent with the pertinent provisions of this appendix.

35 F R 10498

V. INSTRUCTIONS, PROCEDURES, AND DRAWINGS

Activities affecting quality shall be prescribed by documented instructions, procedures, or drawings, or a type appropriate to the circumstances and shall be accomplished in accordance with these instructions, procedures, or drawings. Instructions, procedures, or drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that important activities have been satisfactorily accomplished.

VI. DOCUMENT CONTROL

Measures shall be established to control the issuance of documents, such as instructions, procedures, and drawings, including changes thereto, which prescribe all activities affecting quality. These measures shall assure that documents, including changes, are reviewed for adequacy and approved for release by authorized personnel and are distributed to and used at the location where the prescribed activity is performed. Changes to documents shall be reviewed and approved by the same organizations that performed the original review and approval unless the applicant designates another responsible organization.

VII. CONTROL OF PURCHASED MATERIAL, EQUIPMENT, AND SERVICES

Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery. Documentary evidence that material and equipment conform to the procurement requirements shall be available at the nuclear powerplant or fuel reprocessing plant* site prior to installation or use of such material and equipment. This documentary evidence shall be retained at the nuclear powerplant or fuel reprocessing plant* site and shall be sufficient to identify the specific requirements, such as codes, standards, or specifications, met by the purchased material and equipment. The effectiveness of the control of quality by contractors and subcontractors shall be assessed by the applicant or designee at intervals consistent with the importance, complexity, and quantity of the product or services.

VIII. IDENTIFICATION AND CONTROL OF MATERIALS, PARTS, AND COMPONENTS

Measures shall be established for the identification and control of materials, parts, and components, including partially fabricated assemblies. These measures shall assure that identification of the item is maintained by heat number, part number, serial number, or other appropriate means, either on the item or on records traceable to the item, as required throughout fabrication, erection, installation, and use of the item. These identification and control measures shall be designed to prevent the use of incorrect or defective material, parts, and components.

IX. CONTROL OF SPECIAL PROCESSES

Measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements.

35 F R 10498

X. INSPECTION

A program for inspection of activities affecting quality shall be established and

executed by or for the organization performing the activity to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity. Such inspection shall be performed by individuals other than those who performed the activity being inspected. Examinations, measurements, or tests of material or products processed shall be performed for each work operation where necessary to assure quality. If inspection of processed material or products is impossible or disadvantageous, indirect control by monitoring processing methods, equipment, and personnel shall be provided. Both inspection and process monitoring shall be provided when control is inadequate without both. If mandatory inspection hold points, which require witnessing or inspecting by the applicant's designated representative and beyond which work shall not proceed without the consent of its designated representative are required, the specific hold points shall be indicated in appropriate documents.

XI. TEST CONTROL

A test program shall be established to assure that all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service is identified and performed in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents. The test program shall include, as appropriate, proof tests prior to installation, preoperational tests, and operational tests during nuclear powerplant or fuel reprocessing plant* operation, of structures, systems, and components. Test procedures shall include provisions for assuring that all prerequisites for the given test have been met, that adequate test instrumentation is available and used, and that the test is performed under suitable environmental conditions. Test results shall be documented and evaluated to assure that test requirements have been satisfied.

XII. CONTROL OF MEASURING AND TEST EQUIPMENT

Measures shall be established to assure that tools, gages, instruments, and other measuring and testing devices used in activities affecting quality are properly controlled, calibrated, and adjusted at specified periods to maintain accuracy within necessary limits.

XIII. HANDLING, STORAGE, AND SHIPPING

Measures shall be established to control the handling, storage, shipping, cleaning, and preservation of material and equipment in accordance with work and inspection instructions to prevent damage or deterioration. When necessary for particular products, special protective environments, such as inert gas atmosphere, specific moisture content levels, and temperature levels, shall be specified and provided.

XIV. INSPECTION, TEST, AND OPERATING STATUS

Measures shall be established to indicate, by the use of markings such as stamps, tags, labels, routing cards, or other suitable means, the status of inspections and tests performed upon individual items of the nuclear powerplant or fuel reprocessing plant.* These measures shall provide for the identification of items which have satisfactorily passed required inspections and tests, where necessary to preclude inadvertent bypassing of such inspections and tests. Measures shall also be established for indicating the operating status of structures, systems, and components of the nuclear power plant or fuel reprocessing plant,* such as by tagging valves and switches, to prevent inadvertent operation.

35 FR 10498

XV. NONCONFORMING MATERIALS, PARTS OR COMPONENTS

Measures shall be established to control materials, parts, or components which do not conform to requirements in order to prevent their inadvertent use or installation. These measures shall include, as appropriate, procedures for identification, documentation, segregation, disposition, and notification to affected organizations. Nonconforming items shall be reviewed and accepted, rejected, repaired, or reworked in accordance with documented procedures.

XVI. CORRECTIVE ACTION

Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management.

XVII. QUALITY ASSURANCE RECORDS

Sufficient records shall be maintained to furnish evidence of activities affecting quality. The records shall include at least the following: Operating logs and the results of reviews, inspections, tests, audits, monitoring of work performance, and materials analyses. The records shall also include closely-related data such as qualifications of personnel, procedures, and equipment. Inspection and test records shall, as a minimum, identify the inspector or data recorder, the type of observation, the results, the acceptability, and the action taken in connection with any deficiencies noted. Records shall be identifiable and retrievable. Consistent with applicable regulatory requirements, the applicant shall establish requirements concerning record retention, such as duration, location, and assigned responsibility.

35 FR 10498

XVIII. AUDITS

A comprehensive system of planned and periodic audits shall be carried out to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program. The audits shall be performed in accordance with the written procedures or check lists by appropriately trained personnel not having direct responsibilities in the areas being audited. Audit results shall be documented and reviewed by management having responsibility in the area audited. Followup action, including reaudit of deficient areas, shall be taken where indicated.

* Amended 36 FR 18301.

EXERCISES

The following exercises reinforce the information presented in this module:

1. Research the following reference materials and answer the questions based on the contents of the reference materials:
   - NRC Regulatory Guide 1.33, Quality Assurance Program Requirements (Operations)
   - ANSI N45.2, Quality Assurance Program Requirements for Nuclear Power Plants
   - ANSI N18.7, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants
   - 10 CFR 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants.
   - What is the relationship of Regulatory Guides 1.28 and 1.33 to 10 CFR 50, Appendix B and ANSI N45.2 and ANSI N18.7?
   - Compare the definitions of "quality assurance" given by 10 CFR 50 Appendix B, ANSI N45.2 and ANSI N18.7. Are the definitions identical? What are the differences, if any?
   - Prepare a matrix that correlates paragraph numbers of ANSI N45.2 and ANSI N18.7 with the eighteen criteria of 10 CFR 50, Appendix B. The following format is suggested:

10 CFR 50 Appendix B Criterion	ANSI N45.2 Paragraph No.	ANSI N18.7 Paragraph No.

   - Does ANSI N45.2 cover each of the eighteen criteria of 10 CFR 50, Appendix B? If not, give the rationale for each omission.

- Does ANSI N18.7 cover each of the eighteen criteria of 10 CFR 50, Appendix B? If not, give the rationale for each omission.

2. Compare a Quality Assurance Manual of a nuclear company with applicable reference documents and answer the following questions and perform the stated exercises. (NOTE: The company may be a nuclear utility, construction contractor, NSSS supplier, component supplier or or other type of contractor performing nuclear work. The manual does not have to be the current one in use, i.e., it may be obsolete at the time of use with this activity.)
   - Is the scope of the manual defined? Does the scope list the governing reference document? Name the reference documents.
   - Compare the organizational structure described by the manual with the requirements of the governing reference document. Describe the degree of independence and authority given to the Quality Assurance organization and state if the degree is in compliance with the reference document.
   - Study the section of the manual on procurement and briefly describe the controls employed for (1) qualification of vendors, (2) source inspection, (3) receiving inspection, (4) audits of vendors, (5) procurement document control.
   - Study the section of the manual on Personnel Qualification and briefly describe the controls employed for: (1) qualification of nondestructive examination personnel, (2) qualification of dimensional inspectors.
   - Study the section of the manual on Document Control and: (1) list each type of document that is controlled, (2) briefly describe how the correct docu-

ment is placed into the user's hands, and (3) briefly describe how a QA/QC Technician at a work station could determine if the correct documents are at the work station.

3. Study the following description of documents and prepare a quality assurance procedure for controlling the documents in accordance with Criterion VI of Appendix B to 10 CFR 50:

- Description of Documents - ABC Company installs components in accordance with a "job package" that is prepared for each installation activity. The job package is comprised of all documents needed for the job. A work order form is used to generate the job package and to schedule the work.

  ABC Company's Engineering Department initiates the work order form by assigning a job control number, describing the installation activity in terms of identifying which component is to be installed in which system, naming the installation drawing to be used and stating whether an installation procedure is needed. The work order form then goes to the Engineering Services Department for endorsement. This endorsement acknowledges the work to be done and certifies that an installation procedure will be prepared if Engineering stipulated the need for such a procedure. The work order form then goes to the Central Document Custodian where the job package will be put together. A copy goes to the Installation Coordinator.

  Installation drawings are prepared by Engineering services and reviewed by Quality Assurance and approved by Engineering. Each approved drawing is sent to the Central Document Custodian for maintenance of the master approved drawing file.

Installation procedures are prepared by Engineering Services and approved by Quality Assurance. The installation procedures may require the use of other procedures for welding, radiography and quality control inspection. If welding procedures are necessary, Engineering Services prepares the procedures and submits them to Quality Assurance for approval. Quality Assurance prepares radiography procedures and quality control inspection procedures and submits them to Engineering Services for approval. After approval, all these procedures (installation, welding, radiography, and quality control inspection) are sent to the Central Document Custodian for maintenance of the master file of approved procedures.

When the Installation Coordinator is ready to commence the work, the coordinator requests the Central Document Custodian to issue the job package. The Central Document Custodian assembles the job package and submits it to Quality Assurance for review prior to it being released to the Installation Coordinator for use. The Quality Assurance review confirms that the correct drawing, installation procedure, welding procedure, radiographic procedure, and quality control inspection procedure are included.

- Guidance - The document control procedure should address control of approved documents and changes thereto. After preparation of the procedure, check its validity by determining if it would assure that the Quality Assurance review of the job package could determine for each type of document that the correct number and revision is included in the job package.

MATERIALS

At least one copy of the following materials are required as reference materials to support this module:

1. Title 10, Code of Federal Regulations, Part 50 and Appendix B thereto.
2. Regulatory Guide 1.28, Quality Assurance Program Requirements (Design and Construction)
3. Regulatory Guide 1.33, Quality Assurance Program Requirements (Operation).
4. ANSI N45.2, Quality Assurance Program Requirements for Nuclear Power Plants.
5. ANSI N18.7, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants.

PROCEDURES

Not applicable.

DATA TABLE

Not applicable.

REFERENCE MATERIALS

GPO, Code of Federal Regulations, Title 10, Parts 0-199, U.S. Government Printing Office, 1978

NRC, Regulatory Guide 1,28 Quality Assurance Program Requirements (Design and Construction), U.S. Nuclear Regulatory Commission, 1978

NRC, Regulatory Guide 1.33, Quality Assurance Program Requirements (Operations), U.S. Nuclear Regulatory Commission, 1978

NRC, NUREG-75/087, Standard Review Plan, U.S. Nuclear Regulatory Commission, 1978

ANSI, Quality Assurance Program Requirements for Nuclear Facilities, ANSI N45.2, The American Society of Mechanical Engineers, 1977

ANSI, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants, ANSI N18.7, The American Society of Mechanical Engineers, 1976

ASME, Boiler and Pressure Vessel Code, Section III. Subsection NA, General Requirements, The American Society of Mechanical Engineers, 1978

Enrich, Norbert L., Quality Control and Reliability, Hitchcock Publishing, 1977

Juran, J.M., Quality Control Handbook, Hitchcock Publishing, 1974

TEST

1. Name the regulatory source for quality assurance requirements applicable to nuclear power plants.
2. Name the two principal ANSI standards which provide for the implementation of regulatory requirements.
3. State the purpose of the Design Phase of a QA program.
4. State the purpose of the Construction Phase of a QA program.
5. State the purpose of the Operations Phase of a QA program.
6. What Code of Federal Regulations states the quality assurance requirements for nuclear power plants?
7. What is the purpose of the ANSI N45.2 series of supplementary standards?
8. Define the following terms:
   a. Design Control

   b. Procurement Document Control

   c. Document Control

   d. Test Control

9. How is the effectiveness of a QA program judged?
10. What is meant by the term "Nonconformance"?
11. What standard gives the quality assurance requirements for the Operations Phase of a nuclear power plant?
12. What are the two elements necessary to be performed by every quality assurance activity?
13. What is meant by the term "safety related"?
14. What are the three major areas of design for a nuclear power plant?
15. What is a "Q" list?
16. Describe what is meant by the term "technical requirements".